93263R02

EVALUATION OF MINIBURN TEST DATA FOR THE SQI

Support of Interim Operations

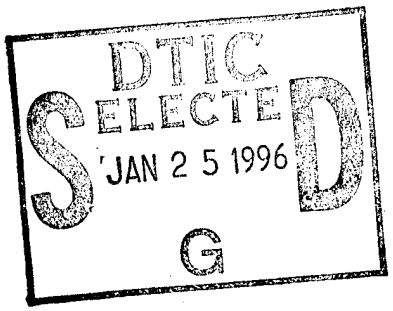
WESTON
MANAGERS DESIGNERS/CONSULTANTS

EVALUATION OF MINIBURN

TEST DATA FOR THE SQI

Support of Interim Operations

23 June 1993



Accesion For	
NTIS CRA&I	☒
DTIC TAB	☐
Unannounced	☐
Justification	
By	
Distribution /	
Availability Codes	
Dist	Avail and / or Special
A-1	

Prepared By:

ROY F. WESTON, INC.
1 Weston Way
West Chester, PA 19380-1499

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY *(Leave blank)*	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	06/23/93	

4. TITLE AND SUBTITLE
EVALUATION OF MINIBURN TEST DATA FOR THE SQI, SUPPORT OF INTERIM OPERATIONS

5. FUNDING NUMBERS

6. AUTHOR(S)

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

ROY F. WESTON, INC.
WEST CHESTER, PA

8. PERFORMING ORGANIZATION REPORT NUMBER

93263R02

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

ROCKY MOUNTAIN ARSENAL (CO.). PMRMA
COMMERCE CITY, CO

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT

APPROVED FOR PUBLIC RELEASE; DISTRIBUTION IS UNLIMITED

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

THE PURPOSE OF THIS REPORT IS TO ANALYZE THE RESULTS OBTAINED DURING TEST BURN RUNS ("MINIBURNS") OF BASIN F LIQUID AT RMA SUBMERGED QUENCH INCINERATOR (SQI). SPECIFICALLY, THE ANALYSIS FOCUSES ON THE FOLLOWING ISSUES: (1) THE NATURE AND LEVEL OF MEASURED RELEASE PRODUCTS, IN COMPARISON TO THOSE PREDICTED (SECTION 2). (2) THE ACTUAL ("AS BUILT") OPERATING CONDITIONS, IN COMPARISON TO THE DESIGN SPECIFICATIONS (SECTION 3) (3) THE ESTIMATED RISK TO HUMAN HEALTH BASED ON THE MEASURED EMISSION RATES, IN COMPARISON TO THOSE BASED ON PREDICTED EMMISSION RATES (SECTION 4). THE PREDICTED EMISSIONS, DESIGN PARAMETERS AND HUMAN RISKS WERE PRESENTED ORIGINALLY IN THE FINAL DRAFT HUMAN HEALTH RISK ASSESSMENT (RTIC # 92222R02).

14. SUBJECT TERMS

CANCER RISKS, HCI, AMMONIA, BASIN F, SQI

15. NUMBER OF PAGES

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
UNCLASSIFIED			

TABLE OF CONTENTS

Section No.	Title	Page
1	**INTRODUCTION**	**1-1**
	1.1 Objectives of Report	1-1
2	**EMISSIONS DATA**	**2-1**
	2.1 Introduction	2-1
	2.2 Test Results	2-1
	2.3 Data Analysis and Comparison With Predicted Emissions Rates	2-2
	2.4 Conclusions	2-10
3	**EVALUATION OF OPERATIONAL PARAMETERS**	**3-1**
	3.1 Objectives	3-1
	3.2 Stack Parameters	3-1
	3.3 Conclusions	3-1
4	**RISK EVALUATION**	**4-1**
	4.1 Introduction	4-1
	4.2 Estimated Risks From Detected Chemicals	4-1
	4.2.1 Emission Rates Used to Estimate Risk	4-1
	4.2.2 Estimated Cancer Risks	4-6
	4.2.3 Estimated Noncancer Risks	4-6
	4.3 Potential Risks From Chemicals Not Detected	4-6
	4.4 Summary and Conclusions	4-9
5	**SUMMARY AND CONCLUSIONS**	**5-1**
6	**REFERENCES**	**6-1**
APPENDIX A	**DETAILED DOCUMENTATION OF RISK EVALUATION FOR 100 PERCENT BASIN LIQUID MINIBURN TEST DATA**	

LIST OF TABLES

Table	Title	Page
2-1	Summary of Particulate, HCI, and Ammonia Test Data and Test Results	2-3
2-2	Summary of Volatile Test Data and Test Results	2-4
2-3	Summary of Semi-Volatile and Organo-Pesticide Compounds Test Data and Test Results	2-5
2-4	Summary of Dioxin/Furan Test Data and Test Results	2-7
2-5	Summary of Metals Test Data and Test Results	2-8
3-1	"Design" Vs. "100 Percent Basin F" Stack Characteristics of the SQI	3-2
3-2	Comparison of "Design" Vs. "100 Percent Basin F" Predicted Maximum One-Hour Concentrations and Distance From The SQI	3-3
4-1	Overview of Exposure Scenarios	4-2
4-2	Final List of Pollutants and Respective Exposure	4-3
4-3	Total Lifetime Carcinogenic Risk for Resident A	4-7
4-4	Total Hazard Index for Resident A Child	4-8
4-5	Summary of Risk Estimates Based on Predicted and Measured Emissions	4-10

SECTION 1
INTRODUCTION

1.1 OBJECTIVES OF REPORT

The purpose of this report is to analyze the results obtained during test burn runs ("miniburns") of Basin F liquid at the Rocky Mountain Arsenal Submerged Quench Incinerator (SQI). Specifically, the analysis focuses on the following issues:

- The nature and level of measured release products, in comparison to those predicted (Section 2).

- The actual ("as-built") operating conditions, in comparison to the design specifications (Section 3).

- The estimated risk to human health based on the measured emission rates, in comparison to those based on predicted emission rates (Section 4).

The predicted emissions, design parameters and human health risks were presented originally in the *Final Draft Human Health Risk Assessment* (WESTON, 1991).

SECTION 2
EMISSIONS DATA

2.1 INTRODUCTION

Roy F. Weston, Inc., (WESTON®) recently completed several tests ("miniburns") at the SQI located at the Rocky Mountain Arsenal in Denver, Colorado. WESTON has reviewed these test results and compared the measured values with the original predicted values in the *Final Draft Human Health Risk Assessment* (WESTON, 1991). This section of the report is a summary of results from the Shakedown Number 4 test program in which the fuel feed to the incinerator was 100 percent Basin F liquid. A review of the 50 percent miniburn data showed that these emissions results were similar to the 100 percent miniburn data set. The 100 percent miniburn data will reflect the expected results from the trial burn and were therefore used in this risk evaluation.

2.2 TEST RESULTS

The sampling and analytical methods used for the Shakedown Number 4 test program consisted of the following:

- Method 0050 (Particulate/HCl)
- Method 5 (Modified to determine ammonia)
- Method 0030 (Volatile organics)
- Method 0010 (Semi-volatile organics and pesticides)
- Method 23 (PCDD/PCDF)
- Method 29 (Multi-metals)

Multiple analyses were performed for each class of chemicals as follows:

Class	Number of Measurements
Acids/Particulates	4
Ammonia	2
Volatile Organics	4
Semivolatile Organics	2
PCDF/PCDD	2
Metals	2

In the case of the volatile organics, two of the runs contained two added principle organic hazardous constituents (POHCs) (carbon tetrachloride and chlorobenzene) for the purpose of estimating destruction removal efficiency (DRE). The DRE was over 99.999% for both chemicals for both runs. These POHCs were not included in the second two test runs.

The results of the analyses for each of the chemical classes are presented in Tables 2-1 to 2-5.

2.3 DATA ANALYSIS AND COMPARISON WITH PREDICTED EMISSION RATES

Inspection of the data presented in Tables 2-1 to 2-5, and comparison of these measured emission rates with the predicted values used in the *Final Draft Human Health Risk Assessment* (WESTON, 1991) reveals the following conclusions:

- There is good reproducibility between measurements. That is, a chemical was usually detected either in all or in none of the measurements. Moreover, when detected in multiple measurements, the values were generally consistent with each other.

- A large number of chemicals originally predicted to be present were not detected in the stack effluent. As discussed in a separate document

TABLE 2-1
RMA - SQI
DENVER, COLORADO
SUMMARY OF PARTICULATE, HCl, AND AMMONIA TEST DATA AND TEST RESULTS

TEST DATA:					AVERAGE	UCL/MAX	1991 PREDICTED BASE CASE EMISSIONS
Test run number	1	2	3	4			
Test date	05-20-93	05-20-93	05-22-93	05-23-93			
Test time period	0959-1247	1311-1540	1545-1803	0753-1030			
							g/sec
PARTICULATE EMISSIONS:							
Concentration, gr/dscf	0.0319	0.0209	0.0245	0.0221	0.0248	0.0307	
Concentration, gr/dscf @7% O2	0.0255	0.0167	0.0202	0.0174	0.0200	0.0247	
Concentration, gr/dscf @12% CO2	0.0399	0.0261	0.0307	0.0265	0.0308	0.0384	
Mass rate, lbs/hr	2.2090	1.4036	1.6307	1.3653	1.6521	2.1101	
Mass rate, g/sec					0.2082	0.2661	0.5000
HCl EMISSIONS:							
Concentration, lbs/dscf	1.29E-07	2.00E-07	2.86E-07	2.81E-07	2.24E-07	2.86E-07	
Concentration, ppm/v	1.3628	2.1189	3.0260	2.9698	2.3694	3.0260	
Mass rate, lbs/hr	0.0624	0.0944	0.1331	0.1218	0.1029	0.1331	
Mass rate, g/sec					0.0130	0.0168	0.1700
POHC Chloride Feed Rate, lb/hr (as HCL)(2)	8.13	8.13	NA	9.92	8.73	9.92	
HCL Removal Efficiency, %[1]	> 99.23	> 98.84	NA	> 98.77	> 98.95	99.23	
TEST DATA:							
Test run number	1	2					
Test date	05-23-93	05-25-93					
Test time period	1223-1427	1119-1351					
AMMONIA EMISSIONS:							
Concentration, lbs/dscf	1.21E-05	7.04E-06			9.59E-06	1.21E-05	
Concentration, ppm/v	275	159			217	275	
Mass rate, lbs/hr	5.61	3.41			4.51	5.61	
Mass rate, g/sec					0.5686	0.7070	0.0060

[1] Inlet chloride feed rate based on carbon tetrachloride and chlorobenzene(POHC) injection rates. This does not account for other chlorides present in Basin F liquid, therefore greater than values are reported for HCl removal efficiency.

TABLE 2-2
RMA - SQI
DENVER, COLORADO
SUMMARY OF VOLATILE TEST DATA AND TEST RESULTS

	1 STACK AVERAGE (2) (POHC ADDED)		2 STACK AVERAGE (2) (POHC ADDED)		3 STACK AVERAGE (2) (NO POHC ADDED)		4 STACK AVERAGE (2) (NO POHC ADDED)		AVERAGE RUNS 1,2,3,and 4		UCL/MAX	1991 BASE CASE PREDICTED EMISSION RATE
	$\mu g/m^3$	g/sec	$\mu g/m^3$	g/sec	$\mu g/m^3$	g/sec	$\mu g/m^3$	g/sec	$\mu g/m^3$	g/sec	g/sec	g/sec
POHC VOST EMISSIONS:												
Carbon Tetrachloride	1.76	6.74E-06	1.54	5.66E-06	ND < 3.86	ND 6.02E-06	ND < 3.76	ND < 6.83E-06	ND[a]	ND	NA	1.56E-08
Chlorobenzene	1.71	6.56E-06	2.55	9.38E-06	ND < 3.86	ND 6.02E-06	ND < 3.76	ND < 6.83E-06	ND[a]	ND	NA	4.15E-09
VOST EMISSIONS:												
Chloromethane (Methyl Chloride)	ND 7.61	ND 1.46E-05	43.56	1.60E-04	9.64	3.01E-05	11.24	4.09E-05	17.06	6.15E-05	1.40E-04	2.53E-05
Bromomethane (Methyl Bromide)	ND 7.61	ND 1.46E-05	ND < 7.34	ND < 1.35E-05	ND < 7.73	ND 1.20E-05	ND 6.15	ND 1.12E-05	ND	ND	NA	9.36E-10
Vinyl Chloride	ND 7.61	ND 1.46E-05	ND 6.20	ND 1.14E-05	ND 6.34	ND 9.89E-06	ND 6.15	ND 1.12E-05	ND	ND	NA	2.55E-05
Chloroethane (Ethyl Chloride)	ND 7.61	ND 1.46E-05	ND 6.20	ND 1.14E-05	ND 6.34	ND 9.89E-06	ND 6.15	ND 1.12E-05	ND	ND	NA	
Methylene chloride (1)	17.34	6.63E-05	14.15	5.21E-05	30.15	9.40E-05	17.70	6.44E-05	19.84	6.92E-05	9.00E-05	2.62E-07
Carbon Disulfide	ND 3.80	ND 7.28E-06	4.18	1.54E-05	ND 3.17	ND 2.47E-06	ND 3.07	ND 5.59E-06	2.30	7.68E-06	1.42E-05	
1,1-Dichloroethene	ND 3.80	ND 7.28E-06	ND 3.10	ND 5.71E-06	ND 3.17	ND 2.47E-06	ND 3.07	ND 5.59E-06	ND	ND	NA	2.35E-08
1,1-Dichloroethane	ND 3.80	ND 7.28E-06	ND 3.10	ND 5.71E-06	ND 3.17	ND 2.47E-06	ND 3.07	ND 5.59E-06	ND	ND	NA	
1,2-Dichloroethene (total)	ND 3.80	ND 7.28E-06	ND 3.10	ND 5.71E-06	ND 3.17	ND 2.47E-06	ND 3.07	ND 5.59E-06	ND	ND	NA	2.16E-09
Chloroform	24.86	9.51E-05	21.01	7.74E-05	29.41	9.17E-05	41.16	1.50E-04	29.11	1.03E-04	1.41E-04	2.70E-08
1,2-Dichloroethane (EDC)	ND 3.80	ND 7.28E-06	ND 3.10	ND 5.71E-06	ND 3.17	ND 2.47E-06	ND 3.07	ND 5.59E-06	ND	ND	NA	
1,1,1-Trichloroethane (TCA)	ND 3.80	ND 7.28E-06	ND 3.10	ND 5.71E-06	ND 3.17	ND 2.47E-06	ND < 3.76	ND < 6.83E-06	ND	ND	NA	
Bromodichloromethane	10.23	3.91E-05	7.72	2.84E-05	11.63	3.63E-05	11.74	4.27E-05	10.33	3.66E-05	4.27E-05	
1,2-Dichloropropane	ND 3.80	ND 7.28E-06	ND 3.10	ND 5.71E-06	ND 3.17	ND 2.47E-06	ND 3.07	ND 5.59E-06	ND	ND	NA	5.77E-08
cis-1,3-Dichloropropene	ND 3.80	ND 7.28E-06	ND < 3.67	ND < 6.76E-06	ND 3.17	ND 2.47E-06	ND 3.07	ND 5.59E-06	ND	ND	NA	
Trichloroethene (TCE)	ND 3.80	ND 7.28E-06	ND 3.10	ND 5.71E-06	ND 3.17	ND 2.47E-06	ND 3.07	ND 5.59E-06	ND	ND	NA	4.62E-08
Dibromochloromethane	ND · 5.77	ND < 1.10E-05	ND < 3.67	ND < 6.76E-06	ND < 3.86	ND 6.02E-06	ND < 3.76	ND < 6.83E-06	ND	ND	NA	
1,1,2-Trichloroethane	ND 3.80	ND 7.28E-06	ND 3.10	ND 5.71E-06	ND 3.17	ND 2.47E-06	ND 3.07	ND 5.59E-06	ND	ND	NA	
Benzene	32.47	1.24E-04	20.63	7.60E-05	ND 3.17	ND 2.47E-06	ND 3.07	ND 5.59E-06	14.05	5.21E-05	1.21E-04	1.37E-08
trans-1,3-Dichloropropene	ND 3.80	ND 7.28E-06	ND 3.10	ND 5.71E-06	ND 3.17	ND 2.47E-06	ND 3.07	ND 5.59E-06	ND	ND	NA	
Bromoform	ND 3.80	ND 7.28E-06	ND 3.10	ND 5.71E-06	ND 3.17	ND 2.47E-06	ND 3.07	ND 5.59E-06	ND	ND	NA	
Tetrachloroethene (PCE)	ND 3.80	ND 7.28E-06	ND 3.10	ND 5.71E-06	ND 3.17	ND 2.47E-06	ND 3.07	ND 5.59E-06	ND	ND	NA	1.42E-08
1,1,2,2-Tetrachloroethane	ND 3.80	ND 7.28E-06	ND 3.10	ND 5.71E-06	ND 3.17	ND 2.47E-06	ND 3.07	ND 5.59E-06	ND	ND	NA	
Toluene	10.43	3.99E-05	6.06	2.23E-05	8.26	2.58E-05	7.58	2.76E-05	8.08	2.89E-05	3.79E-05	2.46E-09
Ethylbenzene	ND · 5.77	ND < 1.10E-05	ND 3.10	ND 5.71E-06	ND 3.17	ND 2.47E-06	ND 3.07	ND 5.59E-06	ND	ND	NA	8.55E-09
Styrene	19.70	7.54E-05	12.96	4.78E-05	20.87	6.51E-05	21.49	7.82E-05	18.76	6.66E-05	7.82E-05	2.54E-05
Xylenes(total)	ND · 5.77	ND < 1.10E-05	ND < 3.67	ND < 6.76E-06	ND < 3.86	ND 6.02E-06	ND < 3.76	ND < 6.83E-06	ND	ND	NA	2.73E-08
Dimethyldisulfide	ND 1.90	ND 7.28E-06	ND 3.10	ND 5.71E-06	ND 3.17	ND 2.47E-06	ND 3.07	ND 5.59E-06	ND	ND	NA	1.30E-05

ND = Not Detected. Half sample detection limit.
[a]Emmision rates for these two chemicals based on runs 3 and 4 only.

TABLE 2-3
RMA - SQI
DENVER, COLORADO
SUMMARY OF SEMI-VOLATILE AND ORGANO- PESTICIDE COMPOUNDS TEST DATA AND TEST RESULTS

Test Data Run number Location Date Time period	1 STACK 05-23-93 1153-1723		2 STACK 05-25-93 1042-1629		AVERAGE		UCL/MAX	1991 PREDICTED BASE CASE EMISSIONS
	µg/dscm	g/sec	µg/dscm	g/sec	µg/dscm	g/sec	g/sec	g/sec
Semivolatile Organic Compounds Emission Concentration Data								
Phenol	2.60 B	8.75E-06 B	2.17 B	7.81E-06 B	2.38	8.28E-06	8.75E-06	1.37E-04
Bis (2-chloroethyl) ether	ND	ND	ND	ND	ND	ND	NA	
2-Chlorophenol	ND	ND	ND	ND	ND	ND	NA	
1,3-Dichlorobenzene	ND	ND	ND	ND	ND	ND	NA	
1,4-Dichlorobenzene	ND	ND	ND	ND	ND	ND	NA	
Benzyl alchohol	ND	ND	ND	ND	ND	ND	NA	
1,2-Dichlorobenzene	ND	ND	ND	ND	ND	ND	NA	
2-Methylphenol	ND	ND	ND	ND	ND	ND	NA	
bis-(2-Chloroisopropyl)ether	ND	ND	ND	ND	ND	ND	NA	
4-Methylphenol	ND	ND	ND	ND	ND	ND	NA	
N-Nitroso-Di-n-propylamine	ND	ND	ND	ND	ND	ND	NA	
Hexachloroethane	ND	ND	ND	ND	ND	ND	NA	
Nitrobenzene	ND	ND	ND	ND	ND	ND	NA	
Isophorone	ND	ND	ND	ND	ND	ND	NA	
2-Nitrophenol	ND	ND	ND	ND	ND	ND	NA	
2,4-Dimethylphenol	ND	ND	ND	ND	ND	ND	NA	
Benzoic acid	54.25 B	1.83E-04 B	23.84 B	8.59E-05 B	39.04	1.34E-04	1.83E-04	1.27E-05
bis(2-Chloroethoxy)methane	ND	ND	ND	ND	ND	ND	NA	
2,4-Dichlorophenol	ND	ND	ND	ND	ND	ND	NA	
1,2,4-Trichlorobenzene	ND	ND	ND	ND	ND	ND	NA	
Naphthalene	ND B	ND B	ND BC	ND BC	ND	ND	NA	
4-Chloroaniline	ND	ND	ND	ND	ND	ND	NA	
Hexachlorobutadiene	ND	ND	ND	ND	ND	ND	NA	
4-Chloro-3-methylphenol	ND	ND	ND	ND	ND	ND	NA	
2-Mehtylnapthalene	ND	ND	ND	ND	ND	ND	NA	
Hexachlorocyclopentadiene	ND	ND	ND	ND	ND	ND	NA	
2,4,6-Trichlorophenol	ND	ND	ND	ND	ND	ND	NA	
2,4,5-Trichlorophenol	ND	ND	ND	ND	ND	ND	NA	
2-Chloronapthalene	ND	ND	ND	ND	ND	ND	NA	
2-Nitroanaline	ND	ND	ND	ND	ND	ND	NA	
Dimethylpthalate	1.15	3.89E-06	1.08	3.90E-06	1.12	3.90E-06	3.90E-06	
Acenaphthylene	ND	ND	ND	ND	ND	ND	NA	
2,6-Dinitrotoluene	ND	ND	ND	ND	ND	ND	NA	
3-Nitroanaline	ND	ND	ND	ND	ND	ND	NA	
Acenapthene	ND	ND	ND	ND	ND	ND	NA	
2,4-Dinitrophenol	ND	ND	ND	ND	ND	ND	NA	
4-Nitrophenol	ND	ND	ND	ND	ND	ND	NA	
Dibenzofuran	ND	ND	ND	ND	ND	ND	NA	
2,4-Dinitrotoluene	ND	ND	ND	ND	ND	ND	NA	
Diethylphthalate	3.17	1.07E-05	3.52	1.27E-05	3.35	1.17E-05	1.27E-05	
4-Chlorophenyl-phenylether	ND	ND	ND	ND	ND	ND	NA	
Fluorene	ND	ND	ND	ND	ND	ND	NA	
4-Nitroanaline	ND	ND	ND	ND	ND	ND	NA	
4,6-Dinitro-2-methylphenol	ND	ND	ND	ND	ND	ND	NA	
n-Nitrosodiphenylamine(1)	ND	ND	ND	ND	ND	ND	NA	
4-Bromophenyl-phenylether	ND	ND	ND	ND	ND	ND	NA	
Hexachlorobenzene	ND	ND	ND	ND	ND	ND	NA	
Pentachlorophenol	ND	ND	ND	ND	ND	ND	NA	
Phenanthrene	ND	ND	ND	ND	ND	ND	NA	
Anthracene	ND	ND	ND	ND	ND	ND	NA	
Carbazole	ND	ND	ND	ND	ND	ND	NA	
Di-n-butylphthalate	ND BC	ND BC	ND BC	ND BC	ND	ND	NA	
Fluoranthene	ND	ND	ND	ND	ND	ND	NA	
Pyrene	ND	ND	ND	ND	ND	ND	NA	
Butylbenzylpthalate	3.46	1.17E-05	ND < 2.71	ND < 4.88E-06	2.41	8.27E-06	1.17E-05	
3,3'-Dichlorobenzidine	ND	ND	ND	ND	ND	ND	NA	
Benzo(a)anthracene	ND	ND	ND	ND	ND	ND	NA	
Chrysene	ND	ND	ND	ND	ND	ND	NA	
bis(2-Ethylhexyl)phthalate	5.77	1.94E-05	5.15	1.85E-05	5.46	1.90E-05	1.94E-05	
Di-n-Octylpthalate	ND	ND	ND	ND	ND	ND	NA	
Benzo(b)fluoranthene	ND	ND	ND	ND	ND	ND	NA	
Benzo(k)fluoranthene	ND	ND	ND	ND	ND	ND	NA	
Benzo(a)pyrene	ND	ND	ND	ND	ND	ND	NA	
Indeno(1,2,3-cd)pyrene	ND	ND	ND	ND	ND	ND	NA	
Dibenzo(a,h)anthracene	ND	ND	ND	ND	ND	ND	NA	
Benzo(g,h,i)perylene	ND	ND	ND	ND	ND	ND	NA	
Quinoline	ND	ND	ND	ND	ND	ND	NA	
4,4-Dichlorobiphenyl	ND	ND	ND	ND	ND	ND	NA	
Pentachlorobenzene	ND	ND	ND	ND	ND	ND	NA	

ND = Not Detected. Half sample detection limit.

TABLE 2-3 (cont)
RMA - SQI
DENVER, COLORADO
SUMMARY OF SEMI-VOLATILE AND ORGANO- PESTICIDE COMPOUNDS TEST DATA AND TEST RESULTS

Test Data Run number Location Date Time period	1 STACK 05-23-93 1153-1723		2 STACK 05-25-93 1042-1629		AVERAGE		UCL/MAX	1991 PREDICTED BASE CASE EMISSIONS
	µg/dscm	g/sec	µg/dscm	g/sec	µg/dscm		g/sec	g/sec
Organochlorine Pesticides/PCB Emission Concentration Data								
Alpha-BHC	ND	ND	ND	ND	ND	ND	NA	
Beta-BHC	ND	ND	ND	ND	ND	ND	NA	
Delta-BHC	ND	ND	ND	ND	ND	ND	NA	
gamma-BHC	ND	ND	ND	ND	ND	ND	NA	
Heptachlor	ND	ND	ND	ND	ND	ND	NA	
Aldrin	ND	ND	ND	ND	ND	ND	NA	
Heptachlor epoxide	ND	ND	ND	ND	ND	ND	NA	
Endosulfan I	ND	ND	ND	ND	ND	ND	NA	
Dieldrin	ND	ND	ND	ND	ND	ND	NA	
4,4'-DDE	ND	ND	ND	ND	ND	ND	NA	
Endrin	ND	ND	ND	ND	ND	ND	NA	
Isodrin	ND	ND	ND	ND	ND	ND	NA	
Endosulfan II	ND	ND	ND	ND	ND	ND	NA	
4,4'-DDD	ND	ND	ND	ND	ND	ND	NA	
Endosulfan sulfate	ND	ND	ND	ND	ND	ND	NA	
4,4'-DDT	ND	ND	ND	ND	ND	ND	NA	
Methoxychlor	ND	ND	ND	ND	ND	ND	NA	
Endrin ketone	ND	ND	ND	ND	ND	ND	NA	
alpha-Chlordane	ND	ND	ND	ND	ND	ND	NA	
gamma-Chlordane	ND	ND	ND	ND	ND	ND	NA	
Toxaphene	ND	ND	ND	ND	ND	ND	NA	
Aroclor-1016	ND	ND	ND	ND	ND	ND	NA	
Aroclor-1221	ND	ND	ND	ND	ND	ND	NA	
Aroclor-1232	ND	ND	ND	ND	ND	ND	NA	
Aroclor-1242	ND	ND	ND	ND	ND	ND	NA	
Aroclor-1248	ND	ND	ND	ND	ND	ND	NA	
Aroclor-1254	ND	ND	ND	ND	ND	ND	NA	
Aroclor-1260	ND	ND	ND	ND	ND	ND	NA	
Organophosphorous Pesticides/PCB Emission Concentration Data								
Atrazine	ND	ND	ND	ND	ND	ND	NA	
Dichlorvos	ND	ND	ND	ND	ND	ND	NA	
Mevinphos	ND	ND	ND	ND	ND	ND	NA	
Ethoprop	ND	ND	ND	ND	ND	ND	NA	
Naled	ND	ND	ND	ND	ND	ND	NA	
Phorate	ND	ND	ND	ND	ND	ND	NA	
Demeton, O	ND	ND	ND	ND	ND	ND	NA	
Demeton, S	ND	ND	ND	ND	ND	ND	NA	
Diazinon	ND	ND	ND	ND	ND	ND	NA	
Disulfoton	ND	ND	ND	ND	ND	ND	NA	
Methyl Parathion	0.52	1.75E-06	ND < 0.11	ND < 1.95E-07	0.29	9.73E-07	1.75E-06	
Ronnel	ND	ND	ND	ND	ND	ND	NA	
Malathion	ND	ND	ND	ND	ND	ND	NA	
Fenthion	ND	ND	ND	ND	ND	ND	NA	
Ethyl Prathion	ND	ND	ND	ND	ND	ND	NA	
Chlorpyrifos	ND	ND	ND	ND	ND	ND	NA	
Fensulfothion	ND	ND	ND	ND	ND	ND	NA	
Trichloronate	ND	ND	ND	ND	ND	ND	NA	
Merphos	ND	ND	ND	ND	ND	ND	NA	
Stirophos	ND	ND	ND	ND	ND	ND	NA	
Bolstar	ND	ND	ND	ND	ND	ND	NA	
Azinphos-methyl	ND	ND	ND	ND	ND	ND	NA	
Coumaphos	ND	ND	ND	ND	ND	ND	NA	
Supona	ND	ND	ND	ND	ND	ND	NA	
Tokuthion	ND	ND	ND	ND	ND	ND	NA	

B = Detected in blank train; reported values have been blank corrected.
BC = Detected in blank train; test run values were less than blank train values.
ND = Not Detected. Half sample detection limit.

TABLE 2-4
RMA - SQI
DENVER, COLORADO
SUMMARY OF DIOXIN/FURAN TEST DATA AND TEST RESULTS

TEST DATA Test run number Test location Test date Test time period	1 STACK 05-23-93 1153-1723		2 STACK 05-25-93 1042-1629		AVERAGE		UCL/MAX	1991 PREDICTED BASE CASE EMISSIONS
	µg/dscm	g/sec	µg/dscm	g/sec	µg/dscm	g/sec	g/sec	g/sec
TOXICITY EQUIVALENCY EMISSIONS (I-TEFs/89)								
2,3,7,8-TCDD	ND	ND	ND	ND	ND	ND	NA	
1,2,3,7,8-PeCDD	1.40E-06	4.89E-12	ND < 1.06E-06	ND < 1.96E-12	9.64E-07	3.42E-12	4.89E-12	
1,2,3,4,7,8-HxCDD	1.40E-07	4.89E-13	ND < 2.64E-07	ND < 4.91E-13	1.36E-07	4.90E-13	4.89E-13	
1,2,3,6,7,8-HxCDD	2.24E-07	7.82E-13	ND < 1.85E-07	ND < 3.44E-13	1.58E-07	5.63E-13	7.82E-13	
1,2,3,7,8,9-HxCDD	1.68E-07	5.86E-13	2.64E-07	9.82E-13	2.16E-07	7.84E-13	9.82E-13	
1,2,3,4,6,7,8-HpCDD	ND	ND	ND	ND	ND	ND	NA	
1,2,3,4,6,7,8,9-OCDD	ND	ND	ND	ND	ND	ND	NA	
Total TCDD	0.0	0.0	0.0	0.0	0.0	0.0	NA	
Total PeCDD	0.0	0.0	0.0	0.0	0.0	0.0	NA	
Total HxCDD	0.0	0.0	0.0	0.0	0.0	0.0	NA	
Total HpCDD	0.0	0.0	0.0	0.0	0.0	0.0	NA	
2,3,7,8-TCDF	ND 2.80E-07	ND < 4.89E-13	2.64E-07	9.82E-13	2.02E-07	7.35E-13	9.82E-13	
1,2,3,7,8-PeCDF	2.80E-07	9.77E-13	1.32E-07	4.91E-13	2.06E-07	7.34E-13	9.77E-13	
2,3,4,7,8-PeCDF	5.59E-06	1.95E-11	5.29E-06	1.96E-11	5.44E-06	1.96E-11	1.96E-11	
1,2,3,4,7,8-HxCDF	1.12E-06	3.91E-12	1.06E-06	3.93E-12	1.09E-06	3.92E-12	3.93E-12	
1,2,3,6,7,8-HxCDF	2.80E-07	9.77E-13	2.64E-07	9.82E-13	2.72E-07	9.79E-13	9.82E-13	
1,2,3,7,8,9-HxCDF	6.15E-07	2.15E-12	5.82E-07	2.16E-12	5.99E-07	2.15E-12	2.16E-12	
2,3,4,6,7,8-HxCDF	1.12E-07	3.91E-13	ND < 2.12E-07	ND < 3.93E-13	1.09E-07	3.92E-13	3.91E-13	
1,2,3,4,6,7,8-HpCDF	5.59E-08	1.95E-13	5.29E-08	1.96E-13	5.44E-08	1.96E-13	1.96E-13	
1,2,3,4,7,8,9-HpCDF	2.80E-08	9.77E-14	1.85E-08	6.87E-14	2.32E-08	8.32E-14	9.77E-14	
1,2,3,4,6,7,8,9-OCDF	3.36E-09	1.17E-14	5.29E-10	1.96E-15	1.94E-09	6.85E-15	1.17E-14	
Total TCDF	0.0	0.0	0.0	0.0	0.0	0.0	NA	
Total PeCDF	0.0	0.0	0.0	0.0	0.0	0.0	NA	
Total HxCDF	0.0	0.0	0.0	0.0	0.0	0.0	NA	
Total HpCDF	0.0	0.0	0.0	0.0	0.0	0.0	NA	
TOTAL 2,3,7,8-TCDD EQUIVALENTS	1.02E-05	3.55E-11	8.52E-06	3.16E-11	9.34E-06	3.36E-11	3.55E-11	1.50E-10

ND = Not Detected. Half sample detection limit.

TABLE 2-5
RMA - SQI
DENVER, COLORADO
SUMMARY OF METALS TEST DATA AND TEST RESULTS

TEST DATA Test run number Test location Test date Test time period	1 05-20-93 0959-1232		2 05-22-92 1545-1803		AVERAGE		UCL/MAX	1991 PREDICTED BASE CASE EMISSIONS
	$\mu g/m^3$	g/sec	$\mu g/m^3$	g/sec	$\mu g/m^3$	g/sec	g/sec	g/sec
METALS								
TRIAL BURN METALS								
Antimony (Sb)	ND	ND	ND	ND	ND	ND	NA	2.28E-05
Arsenic (As)	ND	ND	ND	ND	ND	ND	NA	1.29E-04
Barium(Ba)	1.83	6.96E-06	ND< 2.00	ND< 3.59E-06	1.41	5.28E-06	6.96E-06	3.16E-05
Beryllium(Be)	ND	ND	ND	ND	ND	ND	NA	1.32E-06
Cadmium (Cd)	ND	ND	ND	ND	ND	ND	NA	2.02E-05
Chromium (Cr)	1.31	5.00E-06	ND< 2.41	ND< 4.33E-06	1.26	4.67E-06	5.00E-06	8.88E-06[a]
Copper(Cu)	1701.42	6.48E-03	1646.05	5.93E-03	1673.74	6.20E-03	6.48E-03	1.21E-01
Lead (Pb)	28.40	1.08E-04	21.70	7.81E-05	25.05	9.31E-05	1.08E-04	4.05E-05
Mercury (Hg)	49.05	1.87E-04	56.65	2.04E-04	52.85	1.95E-04	2.04E-04	3.57E-05
Nickel (Ni)	5.72	2.18E-05	ND< 11.45	ND< 2.06E-05	5.72	2.12E-05	2.18E-05	1.03E-03
Selenium(Se)	0.45	1.73E-06	ND< 30.12	ND< 5.42E-05	7.76	2.80E-05	1.73E-06	3.31E-04
Silver(Ag)	1.95	7.41E-06	ND< 4.87	ND< 8.77E-06	2.19	8.09E-06	7.41E-06	3.43E-06
Thallium(Tl)	ND< 0.97	ND< 1.84E-06	93.56	3.37E-04	47.02	1.69E-04	3.37E-04	3.33E-04
Vanadium(V)	1.73	6.60E-06	ND< 3.82	ND< 6.87E-06	1.82	6.74E-06	6.60E-06	8.42E-05
Zinc(Zn)	156.07	5.94E-04	250.95	9.03E-04	203.51	7.49E-04	9.03E-04	5.86E-04
OTHER METALS								
Aluminum(Al)	101.52	3.87E-04	91.60	3.30E-04	96.56	3.58E-04	3.87E-04	6.49E-04
Boron(B)	243.15	9.26E-04	NA	NA	243.15	4.63E-04	9.26E-04	9.63E-04
Calcium(Ca)	205.46	7.83E-04	231.97	8.35E-04	218.71	8.09E-04	8.35E-04	2.02E-05
Cobalt(Co)	ND	ND	ND	ND	ND	ND	NA	2.84E-05
Iron(Fe)	36.97	1.41E-04	30.13	1.08E-04	33.55	1.25E-04	1.41E-04	1.72E-03
Lithium(Li)	ND	ND	ND	ND	ND	ND	NA	3.96E-06
Manganese(Mn)	21.25	8.09E-05	25.50	9.18E-05	23.37	8.64E-05	9.18E-05	2.22E-04
Molybdenum(Mo)	ND	ND	ND	ND	ND	ND	NA	3.97E-04
Tin(Sn)	54.91	2.09E-04	61.09	2.20E-04	58.00	2.15E-04	2.20E-04	2.91E-04
Titanium(Ti)	0.61	2.32E-06	ND< 2.70	ND< 4.86E-06	0.98	3.59E-06	2.32E-06	2.20E-06

[a] Value represents the 1991 predicted emission rate for Cr^{+6}.
ND = Not Detected. Half sample detection limit.

(*Evaluation of The Detection Limits For The SQI Trial Burn Data*, WESTON, 1993), the detection limits for these chemicals were sufficiently low that they would have been observed if they contributed a significant level of risk.

- Most of the chemicals detected during the 100 percent miniburn were expected. The measured emission rates ranged from well below to well above the predicted emission rates (see Tables 2-1 to 2-5).

- Several chemicals were detected in stack emissions during the 100 percent miniburn which were not evaluated in the 1991 predictive risk assessment:

    - Carbon disulfide
    - Bromodichloromethane
    - Methyl parathion
    - Dimethylphthalate
    - Diethylphthalate
    - Butylbenzylphthalate
    - Bis(2-ethylhexyl)phthalate

  The origin of these chemicals is not clear because none were detected in the Basin F liquid, and it is not expected that they would be formed during the incineration process. Nevertheless, all of these chemicals were assumed to be authentic contaminants and were evaluated in the risk evaluation (Section 4).

- Benzene was detected in runs 1 and 2 (where chlorobenzene was added as a "spike"), but not in runs 3 and 4 (when no chemicals were added as a spike). This suggests that the benzene detected in runs 1 and 2 is an artifact due to the breakdown of the added chlorobenzene. However, because this is not certain, and because low levels of benzene were predicted to be present, the measured values of benzene are assumed to be authentic release products.

2.4 CONCLUSIONS

There are a number of differences between the predicted and measured levels of chemicals emitted from the SQI. In some cases, release rates were lower than expected, while in other cases release rates were greater. Several unexpected chemicals were also detected. As discussed in Section 4, these differences result in a decrease in the estimated risk from SQI operations.

SECTION 3
EVALUATION OF OPERATIONAL PARAMETERS

3.1 OBJECTIVES

This section compares the "design" stack parameters (determined from the 100 percent miniburn test) needed to model pollutant dispersion and deposition rates with the "as-built" parameters (presented in the Final Draft Risk Assessment (WESTON, 1991)).

3.2 STACK PARAMETERS

The effect of changes of the main stack physical conditions on the ambient impact of the SQI was determined through an air quality screening modeling analysis of the design stack characteristics used in the original risk assessment and the "as-built" stack characteristics as reflected by the results of the miniburn combusting 100 percent Basin F liquid. The U. S. EPA SCREEN model was used to predict the maximum 1-hr concentration for the "design" and "as-built" stack parameters. The stack parameters and the results of the modeling are presented in Tables 3-1 and Table 3-2, respectively. As seen from Table 3-1, the "100 percent Basin F" ("as-built") values for exit velocity, stack diameter and exit temperature were slightly higher than the design conditions. As shown in Table 3-2, the effect of the "100 percent Basin F" stack parameters on the ambient impact was a 15 percent decrease in the predicted maximum 1-hour pollutant concentration, and an increase of 7 percent of the distance to the maximum predicted concentration.

3.3 CONCLUSIONS

Based on the screening air quality modeling analysis, the environmental impact of the releases measured during the 100 percent miniburn is less than predicted in the *Final Draft Human Health Risk Assessment* (WESTON, 1991).

Table 3-1

"Design" *Vs.* "100 Percent Basin F" Stack Characteristics of the SQI

Parameters	Design[a]	100% Basin F Liquid[b]
Base Elevation (m)	1,578	1,578
Stack Height (m)	30.48	30.48
Inside Diameter (m)	1.02	1.07
Exit Velocity (mps)	14.8	16.2
Exit Temperature (°K)	354	357

[a] Design stack parameters obtained from *Final Draft Human Health Risk Assessment*, June 1991, Table 6-1 (WESTON, 1991).

[b] "As-built" stack parameters obtained from 100 percent Basin F Liquid Miniburn Test Results, 20 May 1993.

Table 3-2

Comparison of "Design" *Vs.* "100 Percent Basin F" Predicted Maximum One-Hour Concentrations and Distance From the SQI

SQI Condition	Maximum 1-hour Concentration ($\mu g/m^3$)	Distance 1-hour Maximum (m)
Design[a]	14.87	329
100% Basin F Liquid[b]	12.63	352

[a]*Final Draft Human Health Risk Assessment*, Section 6 (WESTON, 1991).
[b]100 Percent Basin F Liquid Miniburn Test Results, 20 May 1993.

SECTION 4
RISK EVALUATION

4.1 INTRODUCTION

This section presents the estimated reasonable maximum health risks to the maximally exposed residential population ("Resident A" scenario; WESTON, 1991) due to the release of contaminants in SQI stack effluent measured during the 100 percent miniburn. Table 4-1 reviews the exposure pathways which were evaluated for this scenario, and Table 4-2 shows which chemicals were evaluated for each pathway. All assumptions regarding dispersion, deposition, exposure and toxicity were the same as employed in the 1991 Risk Assessment. For chemicals detected during the miniburn but which were not predicted in the 1991 report, the physical-chemical properties and toxicity values were retrieved from standard literature sources and are presented in Appendix A, along with other documentation of the risk evaluation.

4.2 ESTIMATED RISKS FROM DETECTED CHEMICALS

4.2.1 Emission Rates Used to Estimate Risk

Risks were estimated for all chemicals detected in one or more of the analytical runs performed during the 100 percent miniburn. In accord with EPA (1989) guidance, the emission rate used to calculate exposure point concentrations was equal to the 95th upper confidence limit (UCL_{95}) of the arithmetic mean of the data. When a chemical was detected in one or more samples but was not detected in others, all detected and nondetected samples were included in the average and UCL_{95} calculations employed one-half the reported sample quantitation limit for the nondetects. Also in accord with EPA (1989) guidance, if the UCL_{95} was higher than the highest detected (maximum) value, the highest detected value was selected as the exposure concentration. The resulting emission rates (those used to calculate exposure and risk) are shown in Tables 2-1 to 2-5 (Section 2).

Table 4-1

Overview of Exposure Scenarios

Resident-A Scenario
Receives maximum off-site inhalation exposure of vapors and particulates.
Eats vegetables grown at the maximum off-site dry deposition location.
Eats beef and drinks milk from cattle raised at the farm location.*
Contacts soil at the maximum off-site dry deposition location.
Ingests indoor dust and outdoor soil at the maximum off-site dry deposition location.
Eats fish from Engineers Lake.
Consumes breast milk as an infant.

* A farm was assumed to be located where deposition (wet and dry) and air concentration are highest for that land use.

T:\SQIT4-1A

Table 4-2

Final List of Pollutants and Respective Exposure Pathways to Be Evaluated

Pollutants	Inhalation	Vegetable Consumption	Milk Consumption	Beef Consumption	Soil/Dust Ingestion	Fish Consumption	Dermal Absorption	Breast Milk Ingestion
Organics								
Benzene	X							X
Benzoic Acid	X	X	X	X	X	X	X	X
Bis(2-ethylhexyl)phthalate	X	X	X	X	X	X	X	X
Bromodichloromethane	X							X
Butylbenzyl phthalate	X	X	X	X	X	X	X	X
Carbon disulfide	X							X
Chloroform	X							X
Diethyl phthalate	X	X	X	X	X		X	X
Dimethyl phthalate	X	X	X	X	X		X	X
Dioxins/Furans	X	X	X	X	X	X	X	X
Methyl Chloride	X							X
Methylene Chloride	X							X
Methyl Parathion	X	X	X	X	X	X	X	X
Phenol	X	X	X	X	X		X	X
Styrene	X							X
Toluene	X							X

Table 4-2

Final List of Pollutants and Respective Exposure Pathways to Be Evaluated
(continued)

Pollutants	Inhalation	Vegetable Consumption	Milk Consumption	Beef Consumption	Soil/Dust Ingestion	Fish Consumption	Dermal Absorption	Breast Milk Ingestion
Inorganics								
Aluminum	X							
Ammonia	X							
Barium	X							
Boron	X							
Calcium	X							
Chromium (III)	X							
Chromium (VI)	X							
Copper	X	X	X	X	X	X	X	
Iron	X							
Lead								
Manganese	X							
Mercury	X	X	X	X	X		X	
Nickel	X							
Selenium	X							
Silver	X							
Thallium	X							
Tin	X							

T:\SQIT4-2

Table 4-2

Final List of Pollutants and Respective Exposure Pathways to Be Evaluated
(continued)

Pollutants	Inhalation	Vegetable Consumption	Milk Consumption	Beef Consumption	Soil/Dust Ingestion	Fish Consumption	Dermal Absorption	Breast Milk Ingestion
Titanium	X							
Vanadium	X					X		
Zinc	X					X		
Criteria Pollutants/ Acid Gases								
Hydrogen Chloride	X							
Particulate Matter	X							

X = Pollutant is of potential concern through this exposure route or pathway.

T:\SQIT4-2

4.2.2 Estimated Cancer Risks

Table 4-3 presents the estimated total lifetime cancer risks to "Resident A" based on the chemicals detected during the 100 percent miniburn. As shown, the total cancer risk is estimated to be 8.7E-10, more than 1,000-times less than the benchmark level of concern (1E-06). Risks to other populations are even lower.

4.2.3 Estimated Noncancer Risks

Table 4-4 presents the estimated noncancer risks to the Resident A child. As shown, the screening level Hazard Index (i.e., assuming all of the noncancer effects are additive) is 1.5E-02, nearly 100-fold less than the benchmark level of concern (HI = 1E+00). Because some of the noncancer effects are on separate target tissues and the risks are not additive, the true margin of safety is even larger. As shown in Appendix A, the noncancer risks to the Resident A Adult (6.7E-03) and the Infant (1.0E-02) are both less than for the child, and are also well below the benchmark of 1E+00.

4.3 POTENTIAL RISKS FROM CHEMICALS NOT DETECTED

It is possible that some chemicals are present in the stack effluent at concentration levels too low to be measured. In order to investigate the possible consequence of this, risks were calculated for the Resident A population based on the worst case assumption that all chemicals which were predicted to be present but were not detected were actually present at concentrations equal to their detection limits. (A separate report, entitled "Evaluation of Detection Limits for the SQI Trial Burn Data," WESTON, 1993, presents more detail on this approach). The results are as follows:

TABLE 4-3
TOTAL LIFETIME CARCINOGENIC RISK

RES-A BASE CASE	INHALATION CARC. RISK	INGESTION CARC. RISK	DERMAL CARC. RISK	TOTAL LIFETIME CARC. RISK
ORGANICS				
Benzene	1.88E-11	8.60E-15	NA	1.88E-11
Bis(2-ethylhexyl)phthalate	1.45E-12	3.22E-10	1.84E-14	3.23E-10
Bromodichloromethane	1.42E-11	1.30E-13	NA	1.43E-11
Chloroform	6.11E-11	4.21E-14	NA	6.12E-11
Dioxins/Furans (EPA TEFs)	2.15E-11	2.86E-10	3.62E-13	3.08E-10
Methyl Chloride	4.72E-12	8.92E-14	NA	4.81E-12
Methylene Chloride	7.95E-13	3.31E-14	NA	8.28E-13
Styrene	8.37E-13	1.15E-13	NA	9.52E-13
INORGANICS				
Chromium (VI)	3.73E-11	NE	NA	3.73E-11
Nickel	9.80E-11	NE	NA	9.80E-11
Total	2.59E-10	6.08E-10	3.80E-13	8.67E-10

TABLE 4-4
CHILD HAZARD INDEX

RES-A BASE CASE	INHALATION HAZARD QUOTIENT	VEGETABLE INGESTION HAZARD QUOTIENT	MILK INGESTION HAZARD QUOTIENT	BEEF INGESTION HAZARD QUOTIENT	SOIL/DUST INGESTION HAZARD QUOTIENT	FISH INGESTION HAZARD QUOTIENT	DERMAL EXPOSURE HAZARD QUOTIENT	TOTAL CHILD HAZARD INDEX
ORGANICS								
Benzene	8.41E-07	NA	NA	NA	NA	NA	NA	8.41E-07
Benzoic Acid	1.04E-08	5.41E-10	5.36E-14	8.31E-15	2.56E-11	1.74E-12	1.74E-11	1.09E-08
Bis(2-ethylhexyl)phthalate	8.61E-07	1.64E-06	7.41E-06	3.59E-07	5.43E-10	2.47E-10	3.70E-10	1.03E-05
Bromodichloromethane	4.83E-07	NA	NA	NA	NA	NA	NA	4.83E-07
Butylbenzyl phthalate	1.32E-08	1.11E-07	4.20E-11	2.29E-12	3.27E-11	9.98E-11	2.23E-11	1.24E-07
Carbon Disulfide	1.12E-06	NA	NA	NA	NA	NA	NA	1.12E-06
Chloroform	6.39E-07	NA	NA	NA	NA	NA	NA	6.39E-07
Diethyl phthalate	5.64E-07	1.99E-10	3.95E-14	5.56E-15	8.88E-12	NA	6.05E-12	5.64E-07
Dimethyl phthalate	1.73E-07	7.67E-12	3.25E-16	5.18E-17	2.18E-13	NA	1.49E-13	1.73E-07
Dioxins/Furans (EPA TEFs)	8.04E-06	1.80E-07	7.68E-08	1.31E-08	1.99E-08	5.64E-07	1.35E-08	8.91E-06
Methyl Chloride	3.02E-07	NA	NA	NA	NA	NA	NA	3.02E-07
Methylene Chloride	2.38E-08	NA	NA	NA	NA	NA	NA	2.38E-08
Methyl parathion	1.94E-06	7.62E-08	8.58E-12	1.32E-12	3.92E-09	1.24E-09	2.67E-09	2.03E-06
Phenol	1.02E-07	4.90E-10	1.09E-14	1.75E-15	8.16E-12	NA	5.56E-12	1.03E-07
Styrene	6.19E-08	NA	NA	NA	NA	NA	NA	6.19E-08
Toluene	7.53E-08	NA	NA	NA	NA	NA	NA	7.53E-08
INORGANICS								
Aluminum	4.30E-05	NA	NA	NA	NA	NE	NA	4.30E-05
Ammonia	5.60E-03	NA	NA	NA	NA	NA	NA	5.60E-03
Barium	1.58E-05	NA	NA	NA	NA	NA	NA	1.58E-05
Boron	3.67E-05	NA	NA	NA	NA	NE	NA	3.67E-05
Calcium	9.27E-05	NA	NA	NA	NA	NA	NA	9.27E-05
Chromium (III)	2.14E-06	NA	NA	NA	NA	NA	NA	2.14E-06
Chromium (VI)	7.55E-07	NA	NA	NA	NA	NA	NA	7.55E-07
Copper	1.44E-03	9.33E-07	8.86E-08	1.53E-08	9.54E-08	6.46E-06	6.50E-08	1.45E-03
Iron	3.13E-05	NA	NA	NA	NA	NA	NA	3.13E-05
Manganese	1.82E-04	NA	NA	NA	NA	NA	NA	1.82E-04
Mercury	5.39E-04	3.67E-06	9.86E-08	1.57E-06	3.81E-07	NA	2.59E-07	5.45E-04
Nickel	9.68E-05	NA	NA	NA	NA	NA	NA	9.68E-05
Selenium	1.92E-06	NA	NA	NA	NA	NA	NA	1.92E-06
Silver	1.65E-04	NA	NA	NA	NA	NA	NA	1.65E-04
Thallium	7.48E-04	NA	NA	NA	NA	NA	NA	7.48E-04
Tin	2.44E-05	NA	NA	NA	NA	NE	NA	2.44E-05
Titanium	5.15E-08	NA	NA	NA	NA	NE	NA	5.15E-08
Vanadium	2.93E-05	NA	NA	NA	NA	3.23E-10	NA	2.93E-05
Zinc	2.00E-05	NA	NA	NA	NA	4.84E-08	NA	2.01E-05
CRITERIA POLLUTANTS/ ACID GASES								
Hydrogen Chloride	1.90E-03	NA	NA	NA	NA	NA	NA	1.90E-03
Particulate Matter	4.21E-03	NA	NA	NA	NA	NA	NA	4.21E-03
Total (Hazard Index)	1.52E-02	6.61E-06	7.67E-06	1.96E-06	5.00E-07	7.08E-06	3.41E-07	1.52E-02

Effect Category	Estimated Risk Levels If All Non-Detects Were Assumed to Be Present
Cancer	2.6E-07
Noncancer	2.0E-02

Thus, even under this worst-case scenario (which is considered to be extremely unrealistic), the total cancer and noncancer risks would still be less than the benchmark levels of concern.

4.4 SUMMARY AND CONCLUSIONS

Table 4-5 summarizes the estimated human health risks to nearby residents based on the originally predicted emission rates and on the emission rates measured during the 100 percent miniburn. It is apparent that the total cancer and noncancer risks from all chemicals measured in the 100 percent miniburn test are lower than originally predicted and are well below the cancer and hazard index benchmarks of 1E-06 and 1, respectively. Even using the assumption that all nondetected chemicals originally predicted in the risk assessment (WESTON, 1991) were hypothetically contributing a risk, the total cancer and noncancer risks from all chemicals (both detected and nondetected) would still be below the benchmarks of concern.

Based on the results of the 100 percent miniburn test, it is concluded that the emissions from the SQI will not present human health risks which exceed the benchmarks.

Table 4-5

Summary of Risk Estimates Based on Predicted and Measured Emissions

Category	Estimated Human Health Risk Based On	
	Predicted Emissions[a]	Measured Emissions[b]
Cancer Risk	1.4E-08	8.7E-10
Noncancer Risk[c]		
Adult	7.4E-02	6.7E-03
Child	1.7E-01	1.5E-02
Infant	1.1E-01	1.0E-02

[a] *Final Draft Human Health Risk Assessment*, Section 10 (WESTON, 1991).
[b] 100 Percent Miniburn Test Data, 20 May 1993.
[c] Hazard index.

SECTION 5
SUMMARY AND CONCLUSIONS

The results from the evaluation of emissions data (Section 2) show that for the chemicals detected, the measured emission rates ranged from lower to higher than the predicted base case emission rates. A number of chemicals that were predicted to occur at very low concentrations were not detected.

Evaluation of the stack parameters measured during the 100 percent miniburn revealed only small differences compared to the design parameters (Section 3). The differences which do exist will tend to decrease the level of contaminants which reach the environment.

Quantitative risk evaluation of the test burn emissions data revealed that total risks from the SQI operation are lower than predicted, and are well below the benchmarks of concern (Section 4). Based on these findings, the results of the 100 percent miniburn strongly support the conclusion that operation of the SQI will not result in significant health risks to humans.

SECTION 6

REFERENCES

EPA (U.S. Environmental Protection Agency), 1980. *AWQC for Phthalate Esters, EPA 440/5-80-067, October 1980.*

EPA (U.S. Environmental Protection Agency), 1986. *Superfund Public Health Evaluation Manual.* Office of Emergency and Remedial Response. Washington, D.C. EPA/600/8-91/011B.

EPA (U.S. Environmental Protection Agency), 1989. *Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A)*, Interim Final, EPA/540/1-89/002, December 1989.

Howard, P.H. 1989. *Handbook of Environmental Fate and Exposure Data for Organic Chemicals, Vol I: Large Production and Priority Pollutants*. Lewis Publishers, Inc., Chelsea, Michigan.

Howard, P.H., 1990. *Handbook of Environmental Fate and Exposure Data for Organic Chemicals, Vol II: Solvents*. Lewis Publishers, Inc., Chelsea, Michigan.

Schnoor, J.L., C. Sato, D. McKenchie, and D. Sahoo, 1987. *Process, Coefficients and Models for Simulating Toxic Organics and Heavy Metals in Surface Waters.* Prepared for Environmental Research Laboratory. U.S. Environmental Protection Agency, Athens, Georgia. EPA/600/3-87/-15.

WESTON (Roy F. Weston, Inc.), 1991. *Final Draft Human Health Risk Assessment.* Interim Response Action, Basin F Liquid Incineration Project, Contract No. DACW-45-90-D-0015.

WESTON (Roy F. Weston, Inc.), 1993. *Evaluation of Detection Limits for the SQI Trial Burn Data, Treatment in Final Human Health Multipathway Risk Assessment*. 9 June 1993.

APPENDIX A

DETAILED DOCUMENTATION OF RISK EVALUATION FOR 100 PERCENT BASIN F LIQUID MINIBURN TEST DATA

APPENDIX A

DETAILED DOCUMENTATION OF RISK EVALUATION FOR 100 PERCENT BASIN F LIQUID MINIBURN TEST DATA

The following information is summarized in the Appendix tables:

Table A-1 - Physical/Chemical Parameters For the New Chemicals Detected in the 100 Percent Miniburn

Table A-2 - Carcinogenic Slope Factors For All Detected Chemicals

Table A-3 - Adult Resident A Carcinogenic Risk

Table A-4 - Child Resident A Carcinogenic Risk

Table A-5 - Infant Resident A Carcinogenic Risk

Table A-6 - Total Lifetime Carcinogenic Risk By Exposure Route - Resident A

Table A-7 - Percent Contribution by Pathway For Carcinogens - Resident A

Table A-8 - Noncarcinogenic Reference Doses For All Detected Chemicals

Table A-9 - Adult Resident A Hazard Index

Table A-10 - Infant Resident A Hazard Index

Table A.1
Physical/Chemical Properties for the New Chemicals Detected in the 100% Miniburn

Organics	log Kow	Reference	Koc (ml/g)	Reference	Fish BCF (l/Kg)	Reference
Bis(2-ethylhexyl) phthalate	9.61	Schnoor, 1987	100000	Howard, 1989	77.5	EPA, 1980
Bromodichloromethane	2.10	Schnoor, 1987	53-251	Howard, 1990	NA	
Butyl benzyl phthalate	5.56	Schnoor, 1987	68-350	Howard, 1989	718	Schnoor, 1987
Diethyl phthalate	2.50	EPA, 1986	142	EPA, 1986	117	EPA, 1986
Dimethyl phthalate	1.56	Schnoor, 1987	44-160	Howard, 1989	57	Schnoor, 1987
Methyl Parathion	1.91	EPA,1986	460	EPA, 1986	95	Schnoor, 1987

NA – Not Applicable

Table A-2

Rocky Mountain Arsenal (RMA)
Slope Factors for Carcinogenic Health Effects $(mg/kg/day)^{-1}$

Pollutant	EPA Carcinogenicity Classification	IARC Carcinogenicity Classification	Inhalation Route Slope Factor	Reference or Basis of Inhalation Slope Factor	Oral Route Slope Factor	Reference or Basis of Oral Slope Factor	Dermal Route Slope Factor
Organics							
Bis(2-ethylhexyl)phthalate	B2	2B	1.40E-02	OSF	1.40E-02	IRIS, 1993	2.80E-02 (sv)
Bromodichloromethane	B2	NL	6.20E-02	OSF	6.20E-02	IRIS, 1993	NC (v)
Chloroform	B2	2B	8.10E-02	IRIS, 1993	6.10E-03	IRIS, 1993	NC (v)
Dioxins/Furans (as 2,3,7,8 TCDD)	B2	2B	1.13E+05[a]	EPA, 1992	1.50E+05	EPA, 1992	3.00E+05 (sv)
Methyl Chloride	C	3	6.30E-03	EPA, 1990	1.30E-02	EPA, 1990	NC (v)
Methylene Chloride	B2	2B	1.65E-03	IRIS, 1993	7.50E-03	IRIS, 1993	NC (v)
Styrene	B2	2B	2.00E-03	EPA, 1990	3.00E-02	EPA, 1990	NC (v)
Inorganics							
Chromium (VI)	A[b]	1	4.10E+01	IRIS, 1990	NC	---	NC (i)
Nickel (as soluble salts)	A[b]	1	8.40E-01	IRIS, 1993	NC	---	NC (i)

Footnotes:
NC = Not a carcinogenic concern through the oral and dermal routes of exposure.
NL = Not listed.
OSF = Oral Slope Factor.
- Substance was treated as a volatile (v), semi-volatile (sv), or an inorganic (i) in deriving the dermal slope factor.
[a] Based on a slope factor of 1.56E+05 $(mg/kg/day)^{-1}$, adjusted for 0.75 inhalation retention.
[b] Classification is for the inhalation route only.

T:\SQIT-A-2

TABLE A-3
ADULT CARCINOGENIC RISK

RES-A BASE CASE	VEGETABLE INGESTION CARC. RISK	MILK INGESTION CARC. RISK	BEEF INGESTION CARC. RISK	SOIL/DUST INGESTION CARC. RISK	FISH INGESTION CARC. RISK	DERMAL EXPOSURE CARC. RISK	TOTAL ADULT CARC. RISK
ORGANICS							
Benzene	NA	NA	NA	NA	NA	NA	NA
Bis(2-ethylhexyl)phthalate	2.75E-10	9.46E-12	1.08E-12	1.52E-14	2.80E-14	1.12E-14	2.85E-10
Bromodichloromethane	NA	NA	NA	NA	NA	NA	NA
Chloroform	NA	NA	NA	NA	NA	NA	NA
Dioxins/Furans (EPA TEFs)	7.38E-13	8.49E-14	7.23E-14	2.97E-13	3.42E-11	2.19E-13	3.56E-11
Methyl Chloride	NA	NA	NA	NA	NA	NA	NA
Methylene Chloride	NA	NA	NA	NA	NA	NA	NA
Styrene	NA	NA	NA	NA	NA	NA	NA
INORGANICS							
Chromium (VI)	NA	NA	NA	NA	NA	NA	NA
Nickel	NA	NA	NA	NA	NA	NA	NA
Total	2.75E-10	9.54E-12	1.15E-12	3.12E-13	3.43E-11	2.30E-13	3.21E-10

AED Adult Exposure Duration 64 YEARS

TABLE A-4
CHILD CARCINOGENIC RISK

RES-A BASE CASE	INHALATION CARC. RISK	VEGETABLE INGESTION CARC. RISK	MILK INGESTION CARC. RISK	BEEF INGESTION CARC. RISK	SOIL/DUST INGESTION CARC. RISK	FISH INGESTION CARC. RISK	DERMAL EXPOSURE CARC. RISK	TOTAL CHILD CARC. RISK
ORGANICS								
Benzene	1.14E-11	NA	NA	NA	NA	NA	NA	1.14E-11
Bis(2-ethylhexyl)phthalate	8.79E-13	3.21E-11	4.27E-12	2.11E-13	1.07E-14	4.94E-15	7.29E-15	3.75E-11
Bromodichloromethane	8.56E-12	NA	NA	NA	NA	NA	NA	8.56E-12
Chloroform	3.69E-11	NA	NA	NA	NA	NA	NA	3.69E-11
Dioxins/Furans (EPA TEFs)	1.30E-11	9.88E-14	4.36E-14	1.53E-14	2.10E-13	6.04E-12	1.43E-13	1.95E-11
Methyl Chloride	2.85E-12	NA	NA	NA	NA	NA	NA	2.85E-12
Methylene Chloride	4.80E-13	NA	NA	NA	NA	NA	NA	4.80E-13
Styrene	5.06E-13	NA	NA	NA	NA	NA	NA	5.06E-13
INORGANICS								
Chromium (VI)	2.25E-11	NA	NA	NA	NA	NA	NA	2.25E-11
Nickel	5.92E-11	NA	NA	NA	NA	NA	NA	5.92E-11
Total	1.56E-10	3.22E-11	4.31E-12	2.26E-13	2.21E-13	6.04E-12	1.50E-13	2.00E-10

CED Child Exposure Duration 5 YEARS
CID Child Inhalation Duration 1 YEAR

TABLE A-5
INFANT CARCINOGENIC RISK

RES-A BASE CASE	INHALATION CARC. RISK	BREAST MILK INGESTION CARC. RISK	TOTAL INFANT CARC. RISK
ORGANICS			
Benzene	7.43E-12	8.60E-15	7.44E-12
Bis(2-ethylhexyl)phthalate	5.75E-13	7.16E-14	6.47E-13
Bromodichloromethane	5.60E-12	1.30E-13	5.73E-12
Chloroform	2.42E-11	4.21E-14	2.42E-11
Dioxins/Furans (EPA TEFs)	8.49E-12	2.44E-10	2.53E-10
Methyl Chloride	1.87E-12	8.92E-14	1.96E-12
Methylene Chloride	3.14E-13	3.31E-14	3.47E-13
Styrene	3.31E-13	1.15E-13	4.46E-13
INORGANICS			
Chromium (VI)	1.48E-11	NE	1.48E-11
Nickel	3.88E-11	NE	3.88E-11
Total	1.02E-10	2.45E-10	3.47E-10

IED Infant Exposure Duration
IID Infant Inhalation Duration

TABLE A-6
TOTAL LIFETIME CARCINOGENIC RISK

RES-A BASE CASE	INHALATION CARC. RISK	BREAST MILK INGESTION CARC. RISK	VEGETABLE INGESTION CARC. RISK	MILK INGESTION CARC. RISK	BEEF INGESTION CARC. RISK	SOIL/DUST INGESTION CARC. RISK	FISH INGESTION CARC. RISK	DERMAL EXPOSURE CARC. RISK	TOTAL LIFETIME CARC. RISK
ORGANICS									
Benzene	1.88E-11	8.60E-15	NA	NA	NA	NA	NA	NA	1.88E-11
Bis(2-ethylhexyl)phthalate	1.45E-12	7.16E-14	3.07E-10	1.37E-11	1.29E-12	2.59E-14	3.29E-14	1.84E-14	3.23E-10
Bromodichloromethane	1.42E-11	1.30E-13	NA	NA	NA	NA	NA	NA	1.43E-11
Chloroform	6.11E-11	4.21E-14	NA	NA	NA	NA	NA	NA	6.12E-11
Dioxins/Furans (EPA TEFs)	2.15E-11	2.44E-10	8.37E-13	1.28E-13	8.76E-14	5.07E-13	4.03E-11	3.62E-13	3.08E-10
Methyl Chloride	4.72E-12	8.92E-14	NA	NA	NA	NA	NA	NA	4.81E-12
Methylene Chloride	7.95E-13	3.31E-14	NA	NA	NA	NA	NA	NA	8.28E-13
Styrene	8.37E-13	1.15E-13	NA	NA	NA	NA	NA	NA	9.52E-13
INORGANICS									
Chromium (VI)	3.73E-11	NE	NA	NA	NA	NA	NA	NA	3.73E-11
Nickel	9.80E-11	NE	NA	NA	NA	NA	NA	NA	9.80E-11
Total	2.59E-10	2.45E-10	3.08E-10	1.39E-11	1.38E-12	5.33E-13	4.03E-11	3.80E-13	8.67E-10

TABLE A-7
CARCINOGENIC RISK
CONTRIBUTION BY PATHWAY

RES-A
BASE CASE

Adult	
Inhalation	NA
Ingestion	36.9759
Vegetables	31.7564
Milk	1.1005
Beef	0.1331
Soil\Dust	0.0360
Fish	3.9499
Dermal	0.0265
Child	
Inhalation	18.0256
Ingestion	4.9625
Vegetables	3.7171
Milk	0.4971
Beef	0.0261
Soil\Dust	0.0254
Fish	0.6968
Dermal	0.0173
Infant	
Inhalation	11.7968
Breast Milk Ingestion	28.1954
Total	100.0000

Table A-8

Rocky Mountain Arsenal (RMA)
Reference Doses (RfDs) for Noncarcinogenic Health Effects (mg/kg-day)

Pollutant	Inhalation Route RfD	Reference or Basis of Inhalation RfD	Oral Route RfD	Reference or Basis of Oral RfD	Dermal Route RfD
Organics					
Benzoic Acid	4.00E+00	Oral RfD	4.00E+00	IRIS, 1993	2.00E+00 (sv)
Bis(2-ethylhexyl)phthalate	5.10E-03	ACGIH-TWA	2.00E-02	IRIS, 1993	1.00E-02 (sv)
Bromodichloromethane	2.00E-02	Oral RfD	2.00E-02	IRIS, 1993	NC (v)
Butylbenzyl phthalate	2.00E-01	Oral RfD	2.00E-01	IRIS, 1993	1.00E-01 (sv)
Chloroform	5.00E-02	ACGIH-TWA	1.00E-02	IRIS, 1993	NC (v)
Diethyl phthalate	5.10E-03	ACGIG-TWA	8.00E-01	IRIS, 1993	4.00E-01 (sv)
Dimethyl phthalate	5.10E-03	ACGIH-TWA	1.00E+01	EPA, 1992	5.00E+00 (sv)
Dioxins/Furans (as 2,3,7,8 TCDD)	1.00E-09	Oral RfD	1.00E-09	ATSDR, 1989	5.00E-10 (sv)
Methyl Chloride	1.05E-01	ACGIH-TWA	1.80E-02	Derived	NC (v)
Methylene Chloride	8.57E-01	EPA, 1992	6.00E-02	EPA, 1993	NC (v)
Methyl Parathion	2.04E-04	ACGIH-TWA	2.50E-04	IRIS, 1993	1.25E-04 (sv)
Phenol	1.94E-02	ACGIH-TWA	6.00E-01	IRIS, 1993	3.00E-01 (sv)
Styrene	2.86E-01	IRIS, 1993	2.00E-01	IRIS, 1993	NC (v)
Toluene	1.14E-01	IRIS, 1993	2.00E-01	IRIS, 1993	NC (v)
Inorganics					
Aluminum	2.04E-03[a]	ACGIH-TWA	NE	---	NC (i)
Ammonia	2.86E-02	IRIS, 1993	NE	---	NC (i)

Table A-8

Rocky Mountain Arsenal (RMA)
Reference Doses (RfDs) for Noncarcinogenic Health Effects (mg/kg-day)
(Continued)

Pollutant	Inhalation Route RfD	Reference or Basis of Inhalation RfD	Oral Route RfD	Reference or Basis of Oral RfD	Dermal Route RfD
Barium	1.00E-04	EPA, 1992	NE	---	NC (i)
Boron	5.71E-03	EPA, 1992	NE	---	NC (i)
Calcium	2.04E-03[b]	ACGIH-TWA	NC	---	NC (i)
Chromium (III)	5.10E-04	ACGIH-TWA	NE	---	NC (i)
Chromium (VI)	5.10E-05	ACGIH-TWA	NE	---	NC (i)
Copper	1.02E-03	ACGIH-TWA	3.80E-02	Ebasco, 1990	1.90E-03 (i)
Iron	1.02E-03[c]	ACGIH-TWA	NE	---	NC (i)
Manganese	1.14E-04	IRIS, 1993	NE	---	NC (i)
Mercury	8.57E-05	EPA, 1992	3.00E-04	EPA, 1990	1.50E-05 (i)
Nickel	5.10E-05[d]	ACGIH-TWA	NE	---	NC (i)
Selenium	2.04E-04	ACGIH-TWA	NC	---	NC (i)
Silver	1.02E-05[e]	ACGIH-TWA	NC	---	NC (i)
Thallium	1.02E-04	ACGIH-TWA	NE	---	NC
Tin	2.04E-03	ACGIH-TWA	NE	---	NC (i)
Titanium	1.02E-02[f]	ACGIH-TWA	NE	---	NC (i)
Vanadium	5.10E-05	ACGIH-TWA	7.00E-03	EPA, 1990	NC (i)
Zinc	1.02E-02[g]	ACGIH-TWA	3.00E-01	EPA, 1990	NC (i)

Table A-8

Rocky Mountain Arsenal (RMA)
Reference Doses (RfDs) for Noncarcinogenic Health Effects (mg/kg-day)
(Continued)

Pollutant	Inhalation Route RfD	Reference or Basis of Inhalation RfD	Oral Route RfD	Reference or Basis of Oral RfD	Dermal Route RfD
Other Acid Gases/ Criteria Pollutants					
Hydrogen Chloride	2.00E-03	IRIS, 1993	ID	---	ID
Particulate Matter	1.43E-02	NAAQS	NC	---	NC

Footnotes:

ACGIH-TWA = American Conference of Governmental Industrial Hygienists. Time-Weighted Average
ID = There were insufficient data to predict the fate in either surface water or soil. The chemical was therefore not evaluated through the inhalation or dermal route.
NAAQS = National Ambient Air Quality Standard
NC = Not of concern through this exposure route (see Section 8)
NE = Not evaluated. Substance is of concern through the fish ingestion pathway only, but could not be evaluated due to the availability of a fish bioconcentration factor

- Substance was treated as a volatile (v), semi-volatile (sv), or inorganic (i) in deriving the dermal reference dose.
[a] Converted from TLV for soluble salts as aluminum.
[b] Converted from TLV for calcium oxide and converted to "as calcium."
[c] Converted from TLV for soluble salts as iron, the most conservative value for inorganic iron.
[d] Converted from TLV for soluble compounds as nickel, the most conservative value.
[e] Converted from TLV for soluble compounds as silver, the most conservative value.
[f] Converted from TLV for titanium dioxide and converted to "as titanium."
[g] Converted from TLV for zinc oxide dust rather than fume and converted to "as zinc."

TABLE A-9
ADULT HAZARD INDEX

RES-A BASE CASE	INHALATION HAZARD QUOTIENT	VEGETABLE INGESTION HAZARD QUOTIENT	MILK INGESTION HAZARD QUOTIENT	BEEF INGESTION HAZARD QUOTIENT	SOIL/DUST INGESTION HAZARD QUOTIENT	FISH INGESTION HAZARD QUOTIENT	DERMAL EXPOSURE HAZARD QUOTIENT	TOTAL ADULT HAZARD INDEX
ORGANICS								
Benzene	3.72E-07	NA	NA	NA	NA	NA	NA	3.72E-07
Benzoic Acid	4.59E-09	2.84E-10	9.28E-15	3.33E-15	2.83E-12	7.72E-13	2.09E-12	4.88E-09
Bis(2-ethylhexyl)phthalate	3.81E-07	1.09E-06	1.28E-06	1.44E-07	6.01E-11	1.09E-10	4.42E-11	2.90E-06
Bromodichloromethane	2.14E-07	NA	NA	NA	NA	NA	NA	2.14E-07
Butylbenzyl phthalate	5.87E-09	7.37E-08	7.27E-12	9.18E-13	3.62E-12	4.42E-11	2.67E-12	7.97E-08
Carbon Disulfide	4.98E-07	NA	NA	NA	NA	NA	NA	4.98E-07
Chloroform	2.83E-07	NA	NA	NA	NA	NA	NA	2.83E-07
Diethyl phthalate	2.50E-07	1.15E-10	6.85E-15	2.23E-15	9.84E-13	NA	7.24E-13	2.50E-07
Dimethyl phthalate	7.67E-08	4.25E-12	5.63E-17	2.08E-17	2.42E-14	NA	1.78E-14	7.67E-08
Dioxins/Furans (EPA TEFs)	3.56E-06	9.75E-08	1.17E-08	4.84E-09	2.20E-09	2.50E-07	1.62E-09	3.93E-06
Methyl Chloride	1.34E-07	NA	NA	NA	NA	NA	NA	1.34E-07
Methylene Chloride	1.05E-08	NA	NA	NA	NA	NA	NA	1.05E-08
Methyl parathion	8.60E-07	3.95E-08	1.49E-12	5.31E-13	4.34E-10	5.49E-10	3.19E-10	9.01E-07
Phenol	4.52E-08	2.92E-10	1.89E-15	7.03E-16	9.04E-13	NA	6.65E-13	4.55E-08
Styrene	2.74E-08	NA	NA	NA	NA	NA	NA	2.74E-08
Toluene	3.33E-08	NA	NA	NA	NA	NA	NA	3.33E-08
INORGANICS								
Aluminum	1.90E-05	NA	NA	NA	NA	NE	NA	1.90E-05
Ammonia	2.48E-03	NA	NA	NA	NA	NA	NA	2.48E-03
Barium	6.98E-06	NA	NA	NA	NA	NA	NA	6.98E-06
Boron	1.63E-05	NA	NA	NA	NA	NE	NA	1.63E-05
Calcium	4.10E-05	NA	NA	NA	NA	NA	NA	4.10E-05
Chromium (III)	9.50E-07	NA	NA	NA	NA	NA	NA	9.50E-07
Chromium (VI)	3.34E-07	NA	NA	NA	NA	NA	NA	3.34E-07
Copper	6.37E-04	5.03E-07	1.54E-08	6.15E-09	1.06E-08	2.86E-06	7.77E-09	6.41E-04
Iron	1.39E-05	NA	NA	NA	NA	NA	NA	1.39E-05
Manganese	8.08E-05	NA	NA	NA	NA	NA	NA	8.08E-05
Mercury	2.39E-04	2.01E-06	1.71E-08	6.30E-07	4.21E-08	NA	3.10E-08	2.41E-04
Nickel	4.29E-05	NA	NA	NA	NA	NA	NA	4.29E-05
Selenium	8.50E-07	NA	NA	NA	NA	NA	NA	8.50E-07
Silver	7.29E-05	NA	NA	NA	NA	NA	NA	7.29E-05
Thallium	3.31E-04	NA	NA	NA	NA	NA	NA	3.31E-04
Tin	1.08E-05	NA	NA	NA	NA	NE	NA	1.08E-05
Titanium	2.28E-08	NA	NA	NA	NA	NE	NA	2.28E-08
Vanadium	1.30E-05	NA	NA	NA	NA	1.43E-10	NA	1.30E-05
Zinc	8.88E-06	NA	NA	NA	NA	2.14E-08	NA	8.90E-06
CRITERIA POLLUTANTS/ ACID GASES								
Hydrogen Chloride	8.42E-04	NA	NA	NA	NA	NA	NA	8.42E-04
Particulate Matter	1.87E-03	NA	NA	NA	NA	NA	NA	1.87E-03
Total (Hazard Index)	6.73E-03	3.81E-06	1.33E-06	7.84E-07	5.54E-08	3.13E-06	4.08E-08	6.74E-03

TABLE A-10
INFANT HAZARD INDEX

RES-A BASE CASE	INHALATION HAZARD QUOTIENT	BREAST MILK INGESTION HAZARD QUOTIENT	TOTAL INFANT HAZARD INDEX
ORGANICS			
Benzene	5.50E-07	2.08E-08	5.71E-07
Benzoic Acid	6.78E-09	2.00E-09	8.78E-09
Bis(2-ethylhexyl)phthalate	5.64E-07	1.79E-08	5.81E-07
Bromodichloromethane	3.16E-07	7.32E-09	3.24E-07
Butylbenzyl phthalate	8.67E-09	1.09E-08	1.96E-08
Carbon Disulfide	7.36E-07	4.87E-10	7.36E-07
Chloroform	4.18E-07	4.84E-08	4.66E-07
Diethyl phthalate	3.69E-07	2.34E-10	3.69E-07
Dimethyl phthalate	1.13E-07	5.94E-12	1.13E-07
Dioxins/Furans (EPA TEFs)	5.26E-06	1.14E-04	1.19E-04
Methyl Chloride	1.98E-07	2.67E-08	2.24E-07
Methylene Chloride	1.56E-08	5.15E-09	2.07E-08
Methyl parathion	1.27E-06	3.05E-07	1.58E-06
Phenol	6.68E-08	4.50E-11	6.69E-08
Styrene	4.05E-08	1.34E-09	4.19E-08
Toluene	4.93E-08	8.13E-11	4.94E-08
INORGANICS			
Aluminum	2.81E-05	NE	2.81E-05
Ammonia	3.66E-03	NE	3.66E-03
Barium	1.03E-05	NE	1.03E-05
Boron	2.40E-05	NE	2.40E-05
Calcium	6.07E-05	NE	6.07E-05
Chromium (III)	1.40E-06	NE	1.40E-06
Chromium (VI)	4.94E-07	NE	4.94E-07
Copper	9.42E-04	NE	9.42E-04
Iron	2.05E-05	NE	2.05E-05
Manganese	1.19E-04	NE	1.19E-04
Mercury	3.53E-04	NE	3.53E-04
Nickel	6.33E-05	NE	6.33E-05
Selenium	1.26E-06	NE	1.26E-06
Silver	1.08E-04	NE	1.08E-04
Thallium	4.90E-04	NE	4.90E-04
Tin	1.60E-05	NE	1.60E-05
Titanium	3.37E-08	NE	3.37E-08
Vanadium	1.92E-05	NE	1.92E-05
Zinc	1.31E-05	NE	1.31E-05
CRITERIA POLLUTANTS/ ACID GASES			
Hydrogen Chloride	1.24E-03	NA	1.24E-03
Particulate Matter	2.76E-03	NA	2.76E-03
Total (Hazard Index)	9.95E-03	1.14E-04	1.01E-02